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AUTHOR Davison, Alice
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ABSTRACT

Readability formulas were originally conceived of as being evaluative measures. However, if a text is being rewritten or revised so that it matches a particular level of ability in its intended readers, it is rather inescapable that readability formulas will influence the changes made. Tacitly or not, formulas now are used to diagnose what causes difficulty in reading. If they are used this way, they can only give wrong answers to the question of what changes should be made in a text to make it easier to read. Changes should be made in a text because of inherent difficulty or problems of ambiguity in that text, and not just to influence the score that the text will receive via readability formulas. Any changes that require knowledge of language, literary style, and the ability to express ideas in the best way to communicate the content and logical relations of the text should be left to the writer or editor. A comparison of two versions of four texts--the original and an "easier" adaptation--shows clearly the influence readability formulas now exert on textbook preparation. Among the deleterious changes found in the analysis were the deletion of connectors; loss of causal and other relations between parts of a sentence; loss of background, focus, and topic information; and changes in points of view. (FL)

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CENTER FOR THE STUDY OF READING

Reading Education Report No. 24

READABILITY--APPRAISING TEXT DIFFICULTY

Alice Davison
University of Illinois at Urbana-Champaign

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University of Illinois
at Urbana-Champaign
51 Gerty Drive
Champaign, Illinois 61820

Bolt Beranek and Newman Inc.
50 Moulton Street
Cambridge, Massachusetts 02238

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Readability--Appraising Text Difficulty

Defining the Issues

I have been asked to discuss the general topic of assessing the difficulty of a text (and I will be using this term to refer to any passage of connected written discourse). I will be speaking primarily from a critical point of view about the role of readability formulas in doing the job of assessing the reading difficulty of a text. I will concentrate on the use of readability formulas in a job which should be related centrally to the writing of text books. This job is the assessment of reading difficulty coupled with the diagnosis of the sources of difficulty.

If a particular text passage is to be part of a book or series of materials intended for readers of a particular level of reading ability, then a standard procedure might be to see what the text's level of difficulty is, as measured by two or three of the commonly used readability formulas--and it is a good idea to take an average of the results, since there is always the possibility of an error of a grade or two in the results of any one formula. Then if the text turns out to be too hard, by these measures, one of two possible steps could be taken: (a) The text would be discarded in favor of another comparable text with the appropriate content and lower score of readability. In this case, readability formulas are used in their original purpose of ranking a group of similar books or texts out of books, relative to one another. But there is another possibility: (b) Since well-written texts with

exactly the right subject matter are not always in abundant supply, the text which seems to be too hard might be revised in some ways which remove the sources of the difficulty so that the text is easier to read and is suitable for readers at the designated level of reading ability.

The central question then is, What feature of the text should be changed to make it easier? Here we see the need for some measure which is both evaluative--gives predictions of the level of reading difficulty; and diagnostic--a measure which says what causes the text to be difficult, on the assumption that if some or all of these features of the text are changed, the reading difficulty of the text will be lowered.

Readability formulas were originally conceived of as evaluative measures, and their proponents reiterate that this is the purpose they should be used for. But if a text is being written or revised so that it matches a particular level of ability in its intended readers, it is rather inescapable that readability formulas will influence the changes made, if only because it is usually desirable to try to guarantee that a text has a particular level of difficulty. Tacitly or not, formulas are used to diagnose what causes difficulty in reading. In fact, a participant at the 1979 National Reading Conference expressed surprise that this was an issue of current interest. She and her colleagues had used formulas for years in writing mathematics textbooks.

In this presentation, I will demonstrate that if readability formulas are used in this way, they can only give wrong answers to the question of

what changes should be made in a text to make it easier. I will argue that changes should be made in texts because of inherent difficulty, or problems of ambiguity, etc., in that text, and not just to influence the score which the text will get via readability formulas. Any changes which are made have to be subject to the judgment of the writer or editor, which will include knowledge of language, literary style, etc., and ability to express ideas in the best way which communicates the content and logical relations of the text.

The method that has been used to demonstrate the influence of readability formulas comes from a study by Robert Kantor, myself, and other linguists at the Center for the Study of Reading (Davison, Kantor, Hannah, Hermon, Lutz, & Salzillo, 1980). We compared two versions of four texts, a freely written original in most cases, and a revision or adaptation, which was supposed to be easier to read. The original texts ranged from about Grade 6.5 to Grade 12, while the adaptations ranged from Grade 5 to Grade 8. Thus, we were able to see the changes made in the text by comparing the corresponding parts of the "before" and "after" versions. While some of our points are based originally on a particular kind of reading material, subsequent searching in both text and trade books for children has convinced us that the style of writing which we believe results from relying on readability formulas is quite widespread and is certainly not confined to the materials we studied originally. The reading materials from which these texts were

taken have also been changed somewhat in content, so that more diversity is found, but there do not seem to be changes in ways of treating the language of the texts.

The kinds of changes we studied, and their probable causes, are illustrated below in (1) and (2). The first sample is a sentence with hard words like curative, which must be paraphrased semantically, and proper names like Hipprocrates, so that the full understanding of the sentence depends on knowledge of the identity and importance of a historical figure. The background knowledge is also spelled out in the adapted version. Note that the adapted version is considerably longer, if much clearer, than the original, which is part of a feature article that appeared in the New York Times magazine some years ago.

(1) (original)

Hippocrates (1) recommended (2) milk to his patients as a curative (3) beverage. (4)

(adaptation)

One of the most famous Greek doctors (1) told (2) his patients (2) to drink (4) milk to cure illness. (3) (3)

In the second sample, a long sentence is broken up into separate parts, with a little tidying up, condensation, and elimination of redundant material. Some words are also paraphrased.

(2) (original)

I had kept my nerve pretty well till dawn, just as the faint light was coming, when we looked out and saw the water whirling against the bay window.

(adaptation)

But we all kept our courage up. As the faint light of dawn was coming, we looked out. The water was whirling by.
(we saw)

Inferences which are required are given in parentheses below the sentence.

These changes are not surprising if one keeps in mind that readability formulas measure sentence length and the complexity, unfamiliarity, or length of vocabulary items--see (3):

(3) Readability formulas (sample of types)

(a) Dale and Chall

Comprehension = .1579 (% words not on Dale-Chall list of 3000 common words) + .0496 (words/sentences) + 3.6365.

(b) Gunning

Readability index = .4 (mean sentence length + % words over 2 syllables).

(c) Fry

Grade level = intersection of values for sentence length and word length measured in syllables on the Fry Readability Graph; factors are weighted differently for earlier vs. later grades.

Clearly the changes made here, whatever their intrinsic worth, also do their bit to lower the vocabulary score (1) and sentence length (2). But

note also that simplifications may be contradictory: Paraphrasing lexical items may considerably lengthen the sentence and add subordinate clauses to it, as in (2), while the objective in (2) is to shorten sentences, to break up coordinate clauses, and to eliminate subordinate constructions.

Aside from the possible logical contradiction in taking readability formulas to their extreme conclusion as guides to making changes in texts, I will present some evidence here which strongly suggests that making changes in texts solely in accordance with readability formulas will have several really harmful effects. Changes of the type described above may very seriously distort the logical relations between the parts of the text, sentences, or paragraphs; they may disrupt the presentation of ideas, and make it impossible for the meaning of the original text to be presented in the adapted text. In some cases meaning is simply eliminated; in some cases it is left to the reader to make the correct inferences without many cues as to what the right inference is. The less information is expressed explicitly in the words and syntactic structures of the text, the more load is placed on the ability to make inferences and to use background information. While adults and skilled readers may be able to do this adequately, it is unlikely that all younger inexperienced readers can.

I will begin by giving some examples of the kinds of deleterious changes which are motivated by readability formulas, along with some

examples from the same sources of changes which do not follow from readability formulas, but do make the contents of the original clearer or easier to read. I will also point to some features of texts which are important for ease or difficulty of reading and to which readability formulas cannot possibly be sensitive. (This is also largely true of other formula-like measures of linguistic variables in texts.)

Clause Splitting

As we see in (2), one consequence of sentence shortening is that conjunctions are taken out as clauses are made into independent sentences. Many conjunctions which specify logical and other semantic relations between clauses are also markers of subordinate constructions, and so cannot stay if their complement clauses are made into main clauses. Although synonyms can be used, often the clause connectors are just deleted. In (2), the conjunctions of time are in some sense redundant, though the deletion of till in the revised version of (2) does not convey loss of confidence when dawn began to break, and leaves it up to the reader to infer that the narrator saw the waters whirling by. This is a fairly common example of the meaning of conjunctions being duplicated by normal inferences of connection and relevance.

But in other cases, the loss of connectives is not so harmless. In (4), the conjunction which indicates "means" and marks a subjectless subordinate clause is not kept in the revised version.

(4) (original)

If given a chance before another fire comes, the tree will heal its own wounds by Ø growing bark over the burned part.

(adaptation)

If given a chance before another fire comes, the tree will heal its own wounds. It will grow new bark over the burned part.
(means)
(and next)

Clearly the original sentence is not unclear or ambiguous; it is just fairly long. Making the means clause a separate clause serves to shorten average sentence length. While it is possible to infer the correct meaning, it is equally possible to make the wrong inference, especially if the reader does not know much about how trees work. The following sentence could simply express some event which takes place next, after the tree heals its wounds.

In (5), we see a purpose clause, expressed by a subjectless infinitive construction, replaced by a separate sentence, again to break up a fairly long sentence with a parenthetical clause in the middle of it.

(5) (original)

"I'm going down to the contract," said Jack, "to see that everything is alright."

(adaptation)

"I'm going down to the building project," Jack said. "I have to see if everything is all right." (obligation = purpose?)

While the motivation of breaking up this long sentence may not necessarily be reprehensible, the effect is to replace an unambiguous purpose clause

by an expression of obligation, which is not the same thing at all. From obligation, one might infer purpose, but there is nothing in the sentence which says that this inference must be made. Since the character Jack in this narrative risks his life in a flood to go back to the project, it is more appropriate to express his motivation as his own purpose rather than external obligation. While one could reconstruct the exact meaning of this sentence from the whole narrative, it seems strange to make meaning less explicit in the process of simplification, since more cognitive work is required to construct the meaning of the text.

On the other hand, there are changes which are made in adaptations which run counter to the trend of splitting up sentences with loss of connectives. For example, the change made in (6) actually improves the text.

(6) (original)

We had water to drink after that. We set out basins and caught raindrops. (because) (consequently)

(adaptation)

We set out basins to Ø catch the raindrops so that we would have water to drink.

In the original, the unconjoined sequence of two sentences must be related by the inference that the first sentence describes the result of the events described in the second sentence. The revision reverses the order of the sentences so that they reflect the order in which the events occurred.

Many studies have shown that both adults and children prefer to have clauses mentioned in "natural" order, that is, the order in which the events took place (Linde, 1976; Osgood & Sridhar, 1978; Pearson, 1974-75). In the adapted version, the original two separate sentences are connected by an explicit subordinating connective which expresses result and purpose relations between the clauses. Here the reader is saved a great deal of interpretive work.

Inferences

Causal and other relations between parts of a sentence often depend on specific pieces of information. If this information is deleted, then the correct inference is less clearly determined. For example, in (7), two original sentences contain reduced relative clauses, which express subordinate or background information, and may impose some barriers to language processing of the sentence because the reader must interrupt work on the main clause, keeping the first part in temporary memory.

(7) (original)

Angler fishes, among the most unusual of luminescent fishes, have fingerlike extensions which dangle in front of their mouths. Fishes attracted to these lights are easily caught and eaten.

(adaptation)

Angler fishes ( ) have fingerlike lights which they dangle in front of their large gaping mouths. Fishes in the dark (they can't see?) are easily caught and eaten.

The first of the subordinate constructions is deleted without much effect, since it only contains some justification for the great interest of angler fishes. But the second subordinate construction explains why the angler fish is successful in luring other fish into its mouth. Without this information, all sorts of wrong inferences are possible: that the non-angler fish cannot see their way in the dark, or cannot see the angler fish, etc.

In some cases the adaptor has anticipated the need to fill in for younger readers some information which might be obvious to adults. For example, in (8), the adaptor has carefully added when it froze, obviously not counting on the ability of readers to infer that only skim milk in frozen form would be used in a skating rink.

(8) (original)

> In Toronto, a suburban ice-skating rink was flooded with 250 surplus gallons of it [= skim milk]. Skaters found that it chipped less easily than frozen water.
>
> (adaptation)
>
> An ice-skating rink was flooded with it. Skaters found that when it froze it chipped less easily than frozen water.

One might be able to infer retrospectively that it was frozen after reading the part at the end of the sentence about comparing skim milk to frozen water. But this means false starts and going back and reinterpreting previously interpreted material. The adaptor added length to the sentence, but may have actually facilitated the reader's job of interpreting the sentence, since the added information rules out a blind

alley in interpretation. (Of course, the deletion of the presumably unfamiliar word surplus may make the reader wonder why milk is being used in this unusual and apparently wasteful way.)

One of the deceptive factors in adaptation is the fact that, if the reader pays attention to the text and has a certain amount of background knowledge and inferencing ability, it is possible to communicate the "same" message with simpler words and syntax. Inferences often parallel or duplicate semantic and syntactic relations. But it is far from clear that relying on inferences to communicate what is left out in the name of simplification actually makes the reader's job easier, or if it does, whether the message of the text comes through without distortion. It is possible--and in some cases probable--that a text may be simplified to the point of being readable at a particular level as measured by readability formulas without being comprehensible. Simplification would therefore have defeated its own purpose.

In (9) is given the first paragraph of a book for children on the American Civil War. This paragraph comes from a fairly old trade book chosen as an extreme example of simplification leading to incoherence, and of the amount of inferencing work which is necessary when explicit information is left out.

(9) [1]Before the Civil War the Negroes in the South were slaves. [2]Many
(And after?) (But not in the North?)

people in the North thought that this was wrong and formed a party to
= ? Slavery in South only?
Slavery in general?

prevent the spread of slavery. [3]When this party elected Abraham
(But if slavery in the South is wrong?) (Not the whole country?)

Lincoln President of the United States, people in the slave states

became very angry. [4]They thought Lincoln and his party
(At Lincoln? At the party?) (Reason?)

were going to take their slaves away, and then they would be unable
(Spread of slavery?)

to grow cotton, which was almost the only
(Another issue: How related to slavery?)

thing their farms produced.
(What about farms in the North; how are they different?)

The events which immediately preceded the Civil War and the causes that led up to it are given in one paragraph of 79 words in 13 clauses, 6 main clauses, and 7 subordinate clauses. The message is quite complex, while the language of the paragraph is supposed to be very simple--at least it sounds simplified to an adult. Although the sentences themselves are fairly long, there is only one adverbial subordinate clause, marked by when, and two coordinating conjunctions, and and and then. There are clearly marked subordinate clauses, beginning with that, to, and relative pronouns. An adult who knew American history would probably say that the paragraph says nothing actually wrong, except perhaps that a political party elects a president. All the relations within the paragraph can be inferred, either from using background knowledge plus the contents of the

paragraph, or by eliminating all the inferences which are contradictory and picking the interpretation which fits all of the sentences together.

Yet the paragraph itself is disconnected to the point of incoherence, and it is not clear how it would be interpreted by someone without much background knowledge. I have tried to reconstruct some of the misleading messages which might be inferred along the way. For example, the reference of this in (1) is quite unclear until the fourth sentence is reached, and the phrase spread of slavery contradicts the content of the fourth sentence, which refers to existing slavery. Finally, the relation of slaves to cotton is left completely vague, and it is not made clear that there were both moral and economic aspects to the institution of slavery. The differences between Northern and Southern farms and economy is not made clear, allowing the reader to wonder exactly what the conflict was about. No doubt it would be possible, as an exercise, to rewrite this paragraph, perhaps in shorter sentences, so that the intended message is expressed clearly. One of the obvious changes to make is in the organization and sequence of ideas, and I will return shortly to this theme. What I want to emphasize here is that simplifying words and syntax does not necessarily simplify the task of the reader, and often increases the demands of the text, beyond low-level decoding tasks.

Topic, Background Information, and Focus

I made the uncontroversial claim in the last section that subordinate clauses often express background information, information which is

subordinate to the main topic of the discourse. Thus the syntactic relations of the sentence give some information about the author's characterization of various pieces of information in the text. What happens if the syntactic structures in a long or complex sentence get changed? I want to show here some examples of how the message gets distorted and receives different emphasis when the syntactic form in which the message is expressed gets changed in the process of adaptation or editing. It has been shown in many studies, such as Gourlay and Catlin (1978), Haviland and Clark (1974), Perfetti and Goldman (1975), and Perfetti and Lesgold (1977) that it makes a difference in comprehension, in written or spoken language, whether thematic material comes after an appropriate context which introduces it, or whether there is no such context, or the context is separated by irrelevant material from the thematically marked material (sentence topic for example).

Two notions which are important for describing discourse properties of sentences are focus and topic. The main emphasis of a sentence or focus is often on the last large chunk. The focus in (10) in its original form would therefore seem to be on the creature leaving a luminous trail as it moves about.

(10) (original)

This small sand-dwelling animal emerges at night and secretes a luminous mucus as it moves about.

(adaptation)

This small animal, which lives in the sand, comes out at night. As it moves about, it secretes a luminous substance.

In the adaptation, the sentence is split into two sentences, with the subordinate adverbial clause moved to the front, where it merely expresses background information which is taken as given. Hence, there are two focuses, comes out at night and secretes a luminous substance, each of which receive equal emphasis. The effect communicated is certainly not the same, and not as coherent, as in the longer original, which subordinated a lot of background information about the luminous worms to the main point of the luminous trails.

Somewhat more serious damage can be seen in two versions of a recent sixth-grade science text, in (11).

(11) (First edition) Topic: Visible and invisible creatures in lakes

> You probably saw lily pads, grass, reeds, and water weeds growing in the shallow water near the shore. And maybe there were water striders gliding over the surface of the lake, and small fishes darting among the shadows of the lily pads.

(Second edition)

> You probably saw lily pads, grass reeds and water weeds. These plants grow in the shallow water near the shore. There may have been water striders gliding over the surface of the lake. Did you see small fishes darting in the shadows of the lily pads?

The point of the introductory passage, of which this is a part, is to focus attention first on creatures which can be seen, and then on microorganisms which cannot be seen without a microscope. Clearly someone has been at work shortening sentences, by splitting coordinate sentences such as the last one, and by making subordinate construction into independent

sentences. The subordinate phrase, a reduced relative clause, in the first sentence gives some background information about the location of certain plants. As the original reads, the description of the pond emphasizes the things one sees here and there. The overall topic is a class of large things which can be seen, though each of these things is not particularly important in itself, nor is its location of crucial importance. With the creation of an independent sentence for the subordinate construction, the sequence of topic in the paragraph is distorted. It appears that these plants are in fact a topic in their own right, and the information about where they grow seems to define a new topic of things near the shore. Then the next sentence about water striders has no obvious connection to what goes before. It appeared to at least one adult reader that the emphasis of the revised form was on the location of various items. In the original, it was clear that the first sentence was part of a series of parallel sentences giving instances of lake creatures and plants, and that location was less important background information.

The moral here is that subordinate clauses promoted to main clauses introduce their own sentence topics. If this metamorphosis takes place without regard to the logical connections of sentence topics in a paragraph, the result can be the introduction of incoherence, sentence disconnectedness, and topic shifts, rather than simplification.

The same sort of changes, done with care, can improve a text, as (12) shows.

(12) (original)

In World War II, Japanese naval officers during blackout action near an enemy moistened the powder in the palm of their hands and read their navigation charts in the dim light it produced.

(adaptation)

During World War II Japanese naval officers used this powder. When they were close to the enemy during blackout night action, they moistened the powder in the palm of their hands. They could read their navigation charts in the dim blue light that it gave.

Here the text expresses some fairly complex information about a very unusual kind of substance, about which no one would very likely have any background information. Hence the adaptor took particular care to explain the setting by adding some information (close to the enemy) and by placing background information in subordinate clauses at the beginning of the sentence. The split of the coordinate construction allows two distinct focuses on two salient facts. The division into separate sentences in this case is appropriate to the information which the author and adaptor wanted to communicate.

In (13), we have an original version of a paragraph which packs 9 clauses or large phrases into three long sentences.

(13) (original)

[a]Motor launches take visitors [b]into such a lagoon on the southern coast of Puerto Rico [c]where on dark nights there is a dramatic display of bioluminescence. [d]Curving lines of light fall from the bow [e]as the launch enters the lagoon, and [f]a trail of light is left in the boat's wake.

In the lagoon, [g]which has one of the greatest concentrations of bioluminescence in the world, [h]it appears as though a huge floodlight were burning under the launch, and [i]the bow seems to be plowing into a wall of fire.

(adaptation)

[b]On the southern coast of Puerto Rico is a lagoon [g]that has one of the greatest amounts of bioluminescence in the world. [c]On dark nights, it creates a very dramatic display. [e]As the motor launch enters the lagoon, [d]curving lines of light fall from the bow. [f]A trail of light is left in the boat's wake. [h]It appears as though a huge floodlight were burning under the launch, and [i]the bow seems to be plowing into a wall of fire.

The adaptor wanted to shorten the sentences by splitting up some of the clauses into separate sentences. But the result, while it has nearly the same clause units in five sentences, has also been reorganized in a very clear way, so that the sentence divisions do not create incoherence. The subordinate clauses (c) and (g) have not been made into main clauses which interrupt the flow of ideas, that is, the description of a trip in a motor launch illustrating the curious features of the lagoon. Instead, since they express background information, they have been placed early in the paragraph so that they represent prior information and previous context in relation to the sentences which follow. Their position in the paragraph is the analog of subordinate clause function, and so clause (c) has the same value in the adaptation as in the original, even though it is no longer a subordinate clause. The changes which the adaptor made

here show awareness of text structure and overall logical organization, factors not measured by traditional readability formulas. Clearly, the success of this adaptation is not due to reliance on readability formulas.

Point of View and Evidence

One pattern of change which we noted in the study of adaptations was motivated primarily by a wish to shorten the sentence by deleting what seems to be an extraneous part of it. As illustrated in (14-17), what gets deleted are little adverbs like apparently, supposedly, etc. and main clauses with verbs of perception, belief, or report in them.

(14) (original)

A railroad freight agent has figured that it would require at least 40 modern flat cars to haul just the trunk alone.

(adaptation)

And at least forty freight cars would be needed to haul away just its trunk.

(15) (original)

The Romans were said by Pliny to rub bread soaked in asses' milk on their faces to make them fairer and prevent the growth of beards.

(adaptation)

The Romans rubbed bread soaked in asses' milk on their faces. They thought that this would make their skin paler. They also thought it would keep their beards from growing!

(16) (original)

Nero's wife, Queen Poppea, took a daily bath in it [= milk] and supposedly had 500 beasts on tap for the purpose.

(adaptation)

She kept five hundred animals to make sure of having enough milk each day.

(17) (original)

Apparently, too, most of these fish can control when they flash their lights in the dark waters where they live.

(adaptation)

Most of these fish can control the flashing of their lights.

The function which these constructions have is to express the author's view of the reliability of the statements expressed. In (14), the author shows in the original version that the statement is indeed reliable, since it is based on the word of an expert in freight. In the revised form, the statement is attributed without qualification to the author, who appears omniscient. In (15), the situation is more complicated, since the sentence expresses a report of a belief. We might believe Pliny, who was a contemporary witness, while not accepting the beliefs of his time, that milk is good for suppressing beards. The adaptor takes the tack that it is all right to suppress attribution of true propositions, since they are true anyway and will appear to come from the author. Only when beliefs are bizarre or erroneous are they attributed to other people. But this strategy is misleading, since many statements are probably true,

though based on incomplete or subjective evidence. Learning to judge the reliability of statements depending on their source, who says them, and what qualifications the sources have is an important skill which is part of the competence of an adult reader. Thus, expressions like these, and other things such as adverbs supposedly, etc. have more real importance in the communication of ideas than they might appear to. While their elimination does moderately reduce sentence length and complexity, their absence deprives the unskilled reader of exposure to something very important, something which basal readers in the later grades recognize as important, and something which is introduced as a drill in practice materials. It comes under the heading of distinguishing fact from opinion, and if it is important, as it clearly is, why should opportunities for learning it be routinely eliminated?

In one of the texts which I have quoted from, the narrative of flood survivors, what has also been eliminated are references to the narrator's perceptions. These may be inferred, since the narrator is telling about the events which were witnessed at first hand. But again the story is given in the adaptation the tone of an omniscient author not necessarily present. One would think that references to the narrator's thoughts and feelings at a particular moment in the narrative would help the reader identify with the story more and make it more vivid and easily comprehended.

This assumption is part of some characterizations of readability. That is, people like to read and have less trouble reading texts which make reference to them, or which they can identify with easily (cf. Flesch, 1949, 1951). On this assumption, many history texts for school and pleasure reading try to dramatize or personalize historical events by telling them through the eyes of a particular individual. But this method has its limitations if what the author wants to communicate is primarily historical knowledge, rather than an interesting story which slips in some historical facts as background; as one of my colleagues has pointed out to me, fiction is an excellent way of presenting historical facts in a vivid way.

To look at point-of-view phenomena a little more closely, I extended our study by looking at different treatments of the same historical events. I chose as a difficult test case some books about the War of 1812, which was a particularly incoherent war, taking place over a wide stretch of territory for often unclear and possibly conflicting motives. (The texts involved were all trade books, but the point will apply to history texts as well.) One book which stuck to a summary of events from an objective point of view stated right at the beginning that the war was a fairly strange war, as wars go, and listed some reasons why. While the book did not always make all of the subparts clear or show all the relations between the parts, it at least told the reader what to expect and gave a clear overall framework to place the episodes in. Other, presumably

more readable books described the war through the eyes of various individuals. But this method practically guarantees that the reader will have trouble understanding important facts and piecing together all the parts. No single individual really had an overview of what was going on. So the narrative of people involved in the conflicts of the Midwesterners with the Indians would have no obvious connection with a war conducted on the Great Lakes or the Atlantic coast between the United States and Great Britain. The lesson I want to draw here is that readability is a relative matter, that what makes some aspects of a text readable may not, in the end, serve the overall purpose of allowing a young reader to interpret and remember the content of a text.

The major point I want to make in this talk is that readability is a relative rather than an absolute effect. In part, the readability of the means of communication, the language and organization of the sentences, is relative to the goals of communicating a message. The amount of simplication which a text will be able to undergo is also relative to how much of its content is to be preserved, and the more content must be preserved, the more a text must be paraphrased--and lengthened--or carefully reorganized so that content is expressed in alternative ways. In fact, readability formulas are pretty useless in telling a writer how to do this, as I hope the sorry examples discussed here have shown. The more successful changes have come from the writers

themselves, acting as writers who are aware of text organization, stylistic nuance, and possible ambiguities both implicit and explicit. What I have just said is not novel and has been said many times before, but here are reasons for judging readability formulas as rather useless in defining texts which are readable. Tom Anderson's presentation makes the same point in a different way. He shows that the absence of clear, organizing information and expressions of time and cause may make a text uninterpretable. Exactly those indications of logical relations are the things which readability formulas encourage writers to delete. At best, the need to shorten sentences distracts a writer from other important considerations, such as discourse organization and the inferences which the reader must make. Yet these factors may make the difference between a comprehensible text and one which is not.

What I am arguing for here is basically subjective judgment about a large number of text features which are subtle and often unquantifiable and relative rather than absolute. I do not want to condemn out of hand all objective measures simply because they are objective. Clearly it would be very nice to have alternatives to readability formulas which did a better job. Researchers have proposed such alternatives, at least programmatic ones: Some, such as Endicott (1973), Reddin (1970), Schmidt (1977), and Selden (1977), give different weights to constructions of different difficulty. Others, such as Fagan (1971), Richek (1976), and von Glaserfeld (1970-71), count subordinate clauses, or left branching

structures, or relations which are not indicated with clear, explicit, overt markers. There are formulas based on taxonomies of "hard" constructions, such as those of Botel and Granowsky (1972), Dawkins (1975), and Henry (1977). There are methods, which are themselves pretty subjective and also laborious, for gauging the coherence and complexity of sentences in a text (Kintsch & Vipond, 1979), and other studies (Gourlay & Catlin, 1978) which note the relationship between sentences of overlapping reference. While some are sensitive to discourse notions such as topic, focus, and background information, others are sensitive to number of items referred to and redundancy in the sequence of sentences, or to syntactic complexity of sentences without reference to the organization and sequencing of the information presented.

Each of these gets at some aspect of texts which may contribute to ease or difficulty of reading, though none, to my knowledge, tries to cover all the possible sources of difficulty. What is really needed is a successful cognitive model of language processing which is sensitive to the different loads of semantic, syntactic, and inferential processing. These relations probably change as a child matures, is able to comprehend complex syntax in all contexts rather than just some, and is capable of processing larger chunks of sentences at once. Perfetti and Lesgold (1977) note that while children's short-term memory for items which are processed together may not increase with age, short-term memory's ability to function increases,

so that information is processed faster and more efficiently and encoded in long-term memory. It is also the case that absolute sentence length is not so important (Glazer, 1974), provided that clause boundaries are clearly indicated and clause constituents are not interrupted by sub-constituents.

Complex sentences should therefore be harder to process because they make greater demands on short-term memory than simple clauses or sequences of conjoined clauses. Yet there is a trade-off: One of the functions of harder constructions, such as ones with subordinate constructions, is to make a message more compact, and its internal logical relations more explicit. But there is a trade-off between what a reader can process and how efficiently the message is expressed. There is some evidence (Pearson, 1974-75) that provided they can handle the syntactic structures, children prefer the more explicit and compact form of a message, where causal relations are concerned, or where focus on attributes is involved in relative clauses. (See discussion in Huggins, 1977.) There is also reported evidence that the omission of logical connectives affects comprehension (Irwin, Marshall, & Glock, 1978-79, cited in Irwin & Davis, 1980, who argue for an eclectic approach to assessing readability.)

What I have against readability formulas is not based on a preference for subjective measures, though I am arguing that informed subjective judgment is the best replacement which is available now in children's texts, and the best corrective for the abuses of language. This subjective

judgment might profit, however, by information about what goes on in psychological and linguistic research, on human cognition and ability to process language, on children's acquisition of their language and ability to understand spoken and written language. Much research has been done in the last 50 years on this subject, and this period has seen major theories come and go as more and more sophisticated information about language, thought, and reading has been accumulated.

Readability formulas were originally conceived in the 1920s and 1930s. The ones in common use today were refined in the 1950s, and some work has been done, for instance by Bormuth (1966), on different means of measuring reading comprehension independently of the formulas, and on showing correlations with other variables, such as degree of subordination. But the developments in research about readability formulas have taken place in a manner virtually absolutely independent of research on the central issues of how the human mind processes language. The use of readability formulas can only be stabs in the dark as predictions, and totally uninformative as guides to writing because they do not and cannot define causes of difficulty.

In conclusion, readability formulas have a generally negative and harmful effect on the writing and revising of texts to be used as reading materials. Yet the tradition behind readability formulas, their simplicity--or simple-mindedness--and their cheapness recommend them to many people. It is really a serious dilemma for people who want to

create texts of high quality which are soundly organized and coherent, and who at the same time want to respond to people who demand readability scores instead of relying on experience and judgment. It is to be hoped that much can be done to educate the public about the actual and appropriate values of readability formulas and their serious limitations.

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